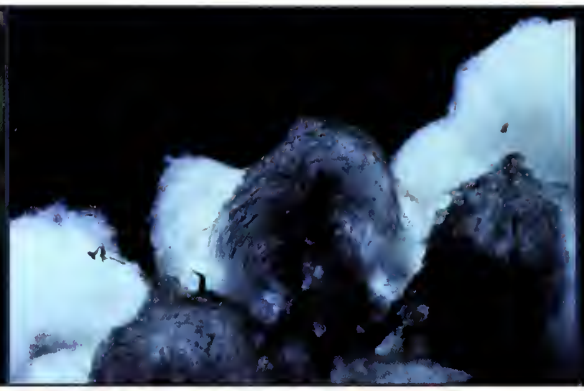
Management of the Silverleaf Whitefly

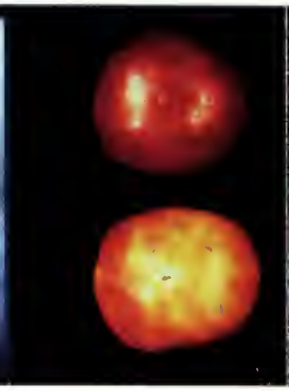
A Success Story in Progress

Cotton leof infested with whiteflies.

Sooty mold ond stickiness on cotton lint.



Irregulor ripening of tomotc



How the problem was identified and addressed

The first major U.S. outbreaks of the silverleaf whitefly (SLWF) occurred in the south-central Florida poinsettia industry in 1986. During the following decade, the SLWF spread across the United States attacking hundreds of different species of crops, weeds and ornamental plant species and quickly became the most destructive agricultural and ornamental pest this century, causing an estimated $1 billion in lost farm income during a six-year period (1986-92).

Economic Impact of the Silverleaf Whitefly

The invasion of the silverleaf whitefly into the irrigated cotton growing regions of south Texas, Arizona and California posed an economic threat to the continued viability of cotton production in the desert Southwest. This area is a cotton production region with gross proceeds of approximately $2 billion at the farm gate.

The SLWF impacted more than just the cotton industry. Its impact on the vegetable, fruit, melon and ornamental crop industry was also significant.

- In Florida, losses in tomatoes from whiteflies and the associated geminivirus, including control costs, were estimated at $125 M.
- In south Texas, cotton and vegetables sustained estimated direct losses of $24 M and $29 M respectively.
- Losses to Texas ornamental crops were estimated at $23.8 M.
- Crop losses for growers in Imperial County, CA, were estimated at $100M and private-sector agricultural sales have lost an additional $172 M.
- The loss of 2,787 agricultural-related jobs have accounted for $25 M in personal income losses.

How the plan was developed

Entomologists and plant pathologists from the Agricultural Research Service, Animal and Plant Health Inspection Service, Cooperative State Research Service, Cooperative Extension Service, State Agricultural Experiment Stations and representatives of the cotton, vegetable, ornamental and nursery industries convened a series of meetings during 1991 and 1992 in response to the serious problem in agricultural crop production systems.

The purpose of the meetings was to develop cooperative research and team efforts, to develop effective, economically and socially acceptable methods of managing sweetpotato whitefly populations. Inherent within the nature of these cooperative efforts were the benefits of communication, exchange of ideas, optimization of resources and priority setting. Annual reviews of progress were scheduled to reassess the problem, identify research areas with a high probability of success, and evaluate the effectiveness of the national effort.

Meetings in 1991 and 1992 culminated in a comprehensive conference report and Five-Year National Research and Action Plan for Development of Management and Control Methodology for the Sweetpotato Whitefly. The five-year plan established annual goals and objectives within six high priority research areas for the project duration.

In September of 1992, an interagency meeting resulted in the recommendation that a USDA Whitefly Research, Education and Action Coordinating Group be formed to help unify interagency activities. The Coordinating Group was composed of principal members from each of the Services and the SAES.

This interagency group was charged with focusing the USDA Interagency and partner State Agricultural Experiment Station resources and providing a mechanism for coordination for research, education, and implementation to effectively manage this pest.

Actions taken to manage the problem

To combat this pest, through USDA coordination, a team of scientists, growers, and agricultural industries was formed to develop a five-year national research and action plan. The plan promoted a coordinated research approach that looked at Integrated Pest Management (IPM), selective and systemic pesticides. [Systemic - a pesticide that moves throughout the plant from its point of treatment so that when the pest feeds on parts of the plant, other than the treated area, it will ingest the pesticide. Selective - a pesticide that affects only the targeted pest and is not detrimental to its natural enemies.]

TIMELINE

1986

The first major outbreaks of SLWF occur in the south-central Florida poinsettia industry.

1986-1992

The SLWF spreads across the United States attacking more than 500 different species of crops, weeds, and ornamental plant species. It became the most destructive agricultural and ornamental pest in decades.

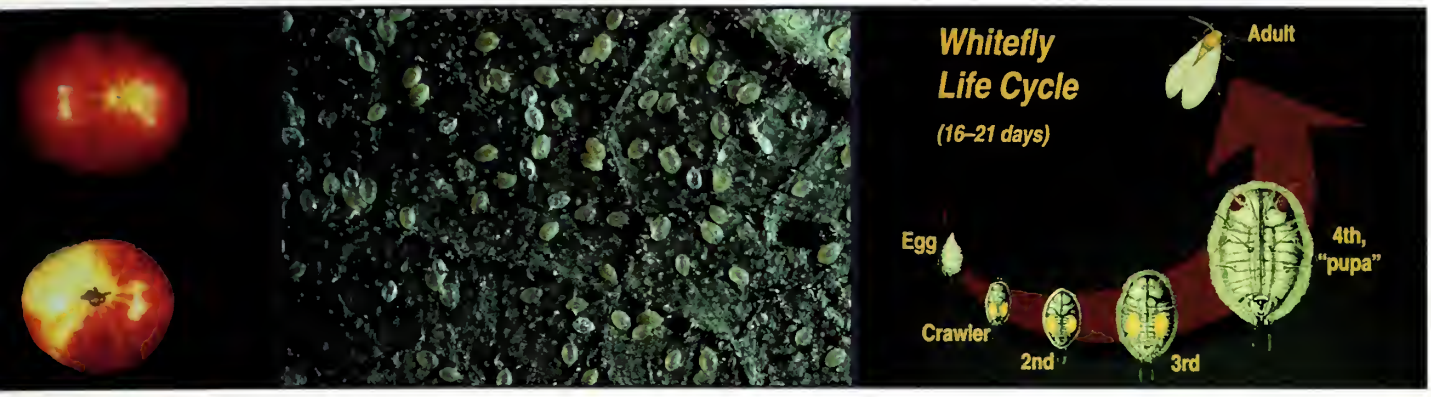
1992

USDA coordinates a team of university scientists, growers and representatives from agricultural industries to develop a five-year national research and action plan for managing this pest.

caused by whitefly feeding.

Silverleaf whitefly nymphs.

Whitefly lifecycle.



The results have been:

- the development and implementation of cultural management techniques that were designed into areawide management programs,
- establishment of economic threshold levels,
- the identification of new natural enemies and diseases as a component to an integrated management of the SLWF,
- the discovery and field development of new agricultural SLWF-selective pesticides and their registration.

Outcomes and Impacts of the Cooperative Program

Used alone, neither chemical, biological nor cultural controls have completely managed the SLWF once it became a pest in field crops. However, integration of multiple control tactics into a strategic management plan has proven most effective. Some of the most effective management strategies discovered by these studies are:

- Studies were conducted to monitor the susceptibility and yield of cotton cultivars to whiteflies. Growers now have available cotton cultivars, which are less susceptible and have reduced losses from whiteflies.
- Research on the synthesis, development, application methodology and field evaluation of several insecticides (both synthetic and naturally-based) has led to new commercial products. Studies have also shown that certain combinations of registered materials on cotton provide substantial improvement over single material application.
- A worldwide search has identified beneficial insects that impact SLWF, which has resulted in mass rearing in quarantine and numerous releases throughout the United States.
- Pest management efficacy trials were conducted on cotton in the desert southwest. Data identified new compounds for the whitefly arsenal.
- Research on SLWF specific diseases has enabled companies to culture, register and formulate large amounts of these important natural enemies.

The Team

The Silverleaf Whitefly Five-Year Technology Transfer and Action Plan was developed and implemented through coordinated and cooperative efforts of several vital team members from government, industries, grower groups, and the agricultural support industries. The goals of this cooperative action plan were to:

- facilitate team research approaches,
- emphasize the highest priority research areas,
- avoid duplication of effort, and
- maximize the use of available resources.

The team members included:

- USDA agencies
  - ARS
  - APHIS
  - CSREES
- State agencies
- State Cooperative Extension and Agricultural Experimental Stations
- Commodity and grower groups for:
  - Cotton
  - Vegetable
  - Nursery crop
- Agro-Chemical Industry

1992-1995
A national research emphasis is placed on the biology, life-history, natural enemies, and chemical efficacy trials conducted in the desert Southwest.

1995-1996
Based on 1994 pest management trials in Texas, Arizona, and California, a whitefly management recommendation booklet is developed and distributed to more than 5,000 Southwest growers.

1996-1997
EPA grants simultaneous emergency use exemptions for two selective whitefly insecticides. A second five-year plan is initiated to continue to increase technology transfer and the development and implementation of a complete IPM program.

- Researchers have developed integrated management programs, which enable releases of natural control agents in concert with chemical insecticide applications.

- Dense whitefly populations cause a mist of sticky excrement called honeydew that accumulates on parts of the plant. New technologies to remove honeydew and a long-term study of the sugar components of whitefly honeydew led to the development of an enzyme that breaks down sugars.

- In Arizona, three years of irrigation water management field studies have determined that when water stress on cotton is avoided, whitefly populations are significantly reduced.

- Cultural pest management technology was disseminated through the Cooperative Extension Service educational programs, publications and pest management recommendations throughout the Southwest United States and northern Mexico.

- More than 28 million natural enemies were distributed for testing and release as potential biological control agents.

- A selective, systemic insecticide has received full federal registrations for several vegetables and has had significant impact on whitefly populations throughout the southern United States.

- Emergency exemptions were requested and granted for two insect growth regulators in Arizona and California. These products are the first insect growth regulators available in the U.S. for whitefly control and were instrumental in areawide management of whiteflies in Arizona and California.

- Collaborative efforts between USDA, Cotton Incorporated, Arizona Cotton Growers Association, and universities in Arizona, California, Florida, Texas, and Israel generated data on efficacy of selective insecticides for whitefly control on cotton. EPA granted Section 18s (emergency use registration) for these insecticides on the same crop-insect complex, a precedent-setting action. Training sessions on the use of these materials were conducted, a whitefly management plan was distributed (5,000 copies) and a videotape was produced. In field demonstrations, insecticide usage for whitefly was reduced by 60 percent.

Economic Benefits of Actions

A good start has been made in developing a strong IPM program for SLWF in a multi-crop production system. Another five-year plan, "The Five-Year National Research and Action Plan for Development of Management and Control Methodology for the Silverleaf Whitefly," was initiated in 1997. The new plan will continue the cooperative research activities begun in the first plan. It defines the continuing need for a highly coordinated and cooperative effort that includes the participation of federal and state agencies, universities, and the agricultural industry. It also establishes new research needs, goals and objectives, and provides for technology transfer to clientele (scientific community, legislators, regulators, the agricultural industry, and the public).

Progress in reaching goals and objectives will be reviewed on an annual basis. The new plan retains flexibility that will allow responsiveness to changing needs and priorities. As the program progresses, participants will redefine essential activities and make appropriate adjustments to terminate, redirect, or add priorities based on funding, current knowledge, and program needs. The primary purpose of the plan is to provide focus for developing essential research and team efforts that will produce environmentally and socially acceptable, efficient and adaptable technologies for potential areawide, community-based silverleaf whitefly management.

Fundamental ecological and biological research on the SLWF and its natural enemies has revealed possible components for incorporation into an ecologically-based management system. The new research and technology transfer plan identifies further research and delivery systems to develop effective management methods and to increase levels of technology transfer.

Other research and action areas of the plan identify and reinforce the need for intensive development of biological and other nonchemical control, disease and SLWF resistant-plant types. Current knowledge of whitefly and natural enemy taxonomy, physiology, biochemistry, and genetics needs to be expanded to effectively deal with this pest in the future.

The beetle, *Delphostus pusillus*, feeding on whitefly eggs.

All stages of greenhouse whiteflies (*Trialeurodes vaporariorum*).